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ABSTRACT

This study explored relationships between gender and the math and science interests of fifth and sixth graders (N=105) who participated in a summer enrichment program for gifted students. A researcher-developed questionnaire was utilized to obtain demographic data about the students and their intent or desire to pursue careers in math and/or science fields. No significant relationship was identified at the fifth grade level between gender and students' interest in math/science careers. However, a significant relationship was apparent for sixth grade students. A similar pattern was revealed for the variable of computers in the home, finding no significant relationship between gender and a computer in the home at the fifth grade level, while finding such a relationship at the sixth grade level. The relationship between students' career interests and their mothers' and fathers' career choices was not significant. Among students who indicated interest in careers involving math and/or science, there was a desire to take additional science courses but not additional math courses. (Contains 11 references.) (DB)

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A Study of Gender Differences in the Math and Science Career Interests of Gifted Fifth and Sixth Graders

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Abstract

This study explored the relationships between gender and the math and science interests of fifth and sixth graders who participated in a summer enrichment program designed for gifted students. A researcher-developed questionnaire was utilized to obtain demographic data about the students and their intent or desire to pursue careers in math and/or science fields. No significant relationship was identified at the fifth grade level between gender and students' interest in careers involving math and/or science, but a significant relationship was apparent for sixth grade students. A similar pattern was revealed for the variable of computers in the home, where there was no significant relationship with career interests at the fifth grade level, but there was a significant relationship between computers in the home and career interests at the sixth grade level.

INTRODUCTION

The much heralded 1992 American Association of University Women (AAUW) report, How Schools Shortchange Girls, presents a compilation of research which deals with the education and educational achievement of American females. The report states that, although gender differences in math achievement and spatial skills have declined somewhat, gender differences in science achievement are not decreasing, and may be increasing. Gender differences also exist in math confidence, and these differences correlate strongly with girls' continuation in math and science courses. Perhaps most notably, gender differences extend to career plans. Even girls who demonstrate exceptional academic preparation in science and math areas choose science and math careers in disproportionately low numbers.

Theoretical Framework

"The educational system is not meeting girls' needs. Girls and boys enter school roughly equal in measured ability. Twelve years later, girls have fallen behind their male classmates in key areas such as higher-level mathematics and measures of self-esteem" (How Schools Shortchange Girls, Executive Summary, 1992, p. 1). That is one of the conclusions drawn from the AAUW study regarding the education American girls receive. While conceding that the differences

between girls and boys in math achievement are small and declining, the report emphasizes that, in high school, girls are still less likely than boys to take the most advanced math courses and to be in the top-scoring math groups.

Girls who view math as something males do perform less well in math than girls who do not hold this view. During the middle school years, girls' math confidence and math achievement decline--the decline in confidence preceding the decline in achievement. Even girls highly competent in math and science are much less likely to pursue scientific or technological careers than are their male classmates (The AAUW Report: How Schools Shortchange Girls, 1992).

As for science, boys tend to come to science classes with more out-of-school familiarity and experience with the subject matter. This advantage is furthered in classrooms where a majority of student-assisted science demonstrations are carried out by boys. Even when girls take advanced science and math courses and do well in them, they often do not receive the encouragement they need to pursue scientific careers, although it has been established that girls rate teacher support as an important factor in decisions to pursue scientific and technological careers (The AAUW Report: How Schools Shortchange Girls, 1992).

Horn (1990) points out that, while young women seem to have narrowed the gender gap in terms of taking math and science courses, they still lag behind young men in terms of taking advanced math and science courses such as calculus and physics. A major purpose of attempting to reduce this gap is to ensure that females do not prematurely exclude themselves from career opportunities by virtue of not completing college and university prerequisite courses in high school. In recent years, the gender gap has decreased in professions such as finance and medicine, but it continues in areas such as scientific research and engineering (Tsuji & Ziegler, 1990).

The science gender gap also appeared in a study conducted by Lovely. Results of that study indicate that females with strong science preparation were just as likely as males with strong science preparation to major in the natural sciences. The attrition rates of science majors also were similiar for both female and male students. However, women with weaker science preparation were more likely to abandon the natural sciences as a major than were men with weaker science preparation (1987).

As mentioned earlier, the self-concepts of females tend to decline as they approach adolescents. In a study which compared gender differences among Asian and Caucasian high school students who were enrolled in advanced math and

science courses, researchers found that both Asian and Caucasian females held less positive attitudes toward themselves than did the males who participated in the study. In addition, as a group, the Asian males held extremely negative stereotypes of the gifted females in their classes, and Caucasian males demonstrated negative perceptions of their gifted female classmates as well (Campbell & Connolly, 1984).

In another study involving gender and ethnic background, results indicated a relationship between students' self-images and commonly held notions of what traits are necessary to be a scientist. Junior high and high school students who viewed themselves as intelligent, creative, self-confident, and independent demonstrated interest in science. Female respondents added competitiveness to the formula of what it takes to be a good scientist. Both gender and ethnic background were found significant in accounting for variation in how students assessed themselves and their abilities. Males and Caucasians were more likely than females and Mexican-Americans to view themselves as creative and intelligent and more likely to demonstrate more interest in science. However, Mexican-Americans reported more interest in taking math than Caucasians did (MacCorquodale, 1984).

Navarro (1989) found, as the AAUW report (1992) reiterates, that men's SAT math scores tend to be higher than

women's SAT math scores. Navarro's analyses revealed that 25% of the difference between women and men's performance on the math portion of the SAT is attributable to differences between genders in terms of the number of years that physics, math, and computer science courses were taken. The disparity in the SAT scores of women and men is particularly interesting in light of the results of studies such as the one conducted by Rallis & Ahern (1986), who found that, at the high school level, girls take as many advanced math and science courses as boys and also receive higher grades in these courses than boys.

Gender and computers were the focus of Wilder, Mackie, and Cooper's 1985 study. In a survey of more than 1,600 K-12 students, results indicated that both sexes view computers and video games as more male appropriate than female appropriate. In addition, both girls and boys reported that science and math are somewhat more male appropriate and are liked less and less as the years pass. Particularly noteworthy was a major downward trend in attitude toward math beginning with the eighth grade.

Although responses from younger subjects consistently reveal that boys, rather than girls, are more likely to have access to home computers, in a follow-up study of ninth graders, Wilder, Mackie, and Cooper (1985) did not find that to be the case. While 35% of female respondents reported having

home computers, 30% of male respondents indicated they had access to home computers. While this study uncovered more positive attitudes toward the computer, gender differences in these attitudes were still evident. Females reported feeling comfortable with computers, but they felt significantly less comfortable compared to male respondents. Females also felt less well prepared to work with computers, although their experiences were not objectively different from those of their male counterparts.

Gender is not necessarily the most important variable in explaining differences in math and science achievement. For example, McConeghy (1987) reported that, in analyses of high school students' math achievement, parents' education and students' race had the greatest influence on math achievement, and gender the least influence, of six significant independent variables identified. However, the fact remains that, even when girls perform as well as, or better than, boys in the math and science areas, they do not perform as well on tests such as the SAT. Neither do they enter careers involving math and/or science to the extent that boys do. Consequently, gender, as it relates to students' math and science achievement, attitudes, and career interests, remains a variable deserving of further study.

Need for the Study

As researchers, as well as teacher educators and advocates for providing appropriate educational opportunities that lead to the fullest possible development of 100% of the population, rather than just 48%, the authors of this paper were interested in determining to what extent emerging adolescents already have incorporated traditional gender role expectations into their academic choices and personal career aspirations. Building on the premise that girls' self-concepts, as well as their math and science achievement, suffer significantly during the emerging adolescent stage, the matter of pinpointing when this decline occurs becomes important. Certainly it is an issue significant to the study of students who have been identified for notable achievements, since the continuing development of their skills and abilities is imperative to students' continued success. Consequently, the study described here was undertaken as a small step toward achieving a better understanding of gender differences that may exist among middle school-aged gifted students, regarding their interest in math and science and careers involving math and/or science.

Purpose of the Study

This study focused on the math and science interests of fifth and sixth grade students. The specific questions posed by the study follow.

1. What is the relationship between gender and students' desire to take math and science courses?
2. What is the relationship between gender and students' interests in careers involving math and/or science?
3. What is the relationship between gender and home computers?
4. What is the relationship between being a first-born or only child and interests in careers involving math and/or science?
5. What is the relationship between parents' careers and their children's interests in careers involving math and/or science?

METHODOLOGY

Subjects

The subjects who participated in this study consisted of 105 students in grades five and six who attended one or more summer courses of the Bradley University Institute for Gifted and Talented Youth. Of this total, 55 students (29 male and 26 female) were in the fifth grade, 50 of the students (27 male and 23 female) were in the sixth grade, and almost all were Caucasian.

Institute staff determine students' eligibility for the summer program based on objective measures (e.g., achievement test scores, IQ test scores, grades) and on

professional judgment (e.g., teacher recommendations, work samples). The process of identification is intended to be inclusive rather than exclusive, with a focus on students' strengths and what they do well, rather than an obsession with students' weaknesses and what they do not do well.

In selecting students for the Summer Institute, program personnel consider these questions: "Will this student benefit from the courses offered by the Summer Institute?" and "Is this student described by the definition of gifted and talented children found in The Illinois School Code? Article 14-A of the state's code states: "Gifted and talented children in Illinois are identified as those children whose mental development is accelerated beyond the average or who have demonstrated a specific aptitude or talent...those with exceptional ability in academic subjects, high level though processes, divergent thinking, creativity in the arts."

Materials

A researcher-developed questionnaire was utilized in this study. The questionnaire was designed to obtain demographic data about the students and their intent or desire to pursue careers in math and/or science fields. The questionnaire addressed factors such as students' attitudes toward math and science, students' career interests, students' use of home computers, and parents' careers.

Procedures

All fifth and sixth grade students who attended one or more Summer Institute courses completed the questionnaire, which was administered by the researchers within the Institute's regularly scheduled classses. Small groups of 10 to 20 students were given approximately 20 minutes to complete the questionnaire, following an explanation of its purpose. Respondents were encouraged to ask questions regarding directions and any parts of the questionnaire which they did not understand clearly.

Data Analyses

The data from all subjects were entered into the Statview statistical program for analysis. A correlation matrix was calculated to determine if relationships existed among the following variables: gender, first born, only child, mother's career choice, father's career choice, child's interest in careers involving math and/or science, desire to take more math courses, desire to take more science courses, and computers in the home. An artificial dichotomy was created for career choice, with careers in math and science fields assigned to yes and other career choices assigned to no. The correlation matrix was also calculated separately for grade five, and again for grade six.

RESULTS

The compilation of responses from all students demonstrated a significant (alpha = .05) relationship between gender and students' desire to pursue careers involving math and/or science (r=+.232), with males more frequently indicating interest in math and/or science careers. The results from all students also indicated the existence of a significant relationship between students' interest in careers involving math and/or science and their desire to take more science courses (r=+.384). The same was not true of the desire to take more math courses. Also insignificant was the relationship between the respondents' career interests and their mothers' and fathers' careers. Neither was a relationship demonstrated between being a first born or only child and the respondents' career interests, nor between a computer in the home and career interests.

The results from the fifth grade students revealed a significant (alpha = .05) relationship between students' interest in careers involving math and/or science and their desire to take more science courses (r=+.378). However, there was not a significant relationship between students' interest in careers involving math and/or science and their desire to take more math courses. Neither was there a significant relationship demonstrated between: gender and students' interest in

careers involving math and/or science, respondents' career interests and their mother and fathers' career choices, being a first born or only child and the respondents' career interests, nor between a computer in the home and career interests.

The results from the sixth grade students showed a significant (alpha = .05) relationship between gender and students' interest in careers involving math and/or science (r=+.329). There also were significant relationships between gender and a computer in the home (r=+.322), and between students' interest in careers involving math and/or science and their desire to take more science courses (r=+.465). However, here again there was not a significant relationship between students' interest in careers involving math and/or science and their desire to take more math courses or between being a first born or only child and career interests. In addition, the relationship between the respondents' career interests and their mother and fathers' career choices was not significant.

CONCLUSIONS AND RECOMMENDATIONS

Disaggregating the data by grade level revealed two differences between the responses of the fifth and sixth grade students who participated in this study. Fifth grade results demonstrated no significant relationship between gender and students' interest in careers involving math and/or science, in contrast to results from the total sample. However, sixth grade

results showed a significant (alpha = .05) relationship between gender and students' interest in careers involving math and/or science. Sixth grade results also indicated a significant relationship between gender and a computer in the home (r = +.322), a relationship which did not prove significant in a separate analysis of fifth grade results.

Summary

It appears from these data that the relationship between gender and students' interest in careers involving math and/or science may develop in the middle school years. No significant relationship was present between these two variables in fifth grade, but a significant relationship was apparent for sixth grade students. A similar pattern was revealed for the variable of computers in the home, where there was no significant relationship with career interests at the fifth grade level, but there was a significant relationship between computers in the home and career interests at the sixth grade level.

It also appears that, among students who indicate interest in careers involving math and/or science, there is the desire to take additional science courses, but not additional math courses. Finally, the relationship between the respondents' career interests and their mother and fathers' career choices was not significant.

Educational Significance

The key finding that separates this study's results from the results of other studies lies in the fact that no significant relationship was found between gender and fifth grade students' interest in pursuing careers involving math and/or science, although a significant relationship between these two variables was demonstrated for sixth grade students. Such results, when considered in light of what is known about the tendency for girls' self-concept, and subsequently their achievement, to drop during early adolescence, lead to the conclusion that further study is warranted. Particular attention needs to be paid to the possibility of pinpointing exactly when the relationship between gender and students' interest in math and/or science careers begins to develop.

Such knowledge would enable educators, parents, and other adults who play roles in the development of emerging adolescents to provide the support and opportunities which may result in more girls acknowledging their math and science abilities and, in turn, pursuing careers which match those abilities. Parents and teachers can assign competence to girls, as well as to boys, by communicating to them both verbally and non-verbally that they are mathematically and scientifically competent and capable of high achievement in these areas.

Schools and colleges can offer a variety of math and science courses which actively involve all students in the learning process, regardless of gender. They can make clear that they do not view certain courses and careers as female options and other courses and careers as male options. Finally, schools and colleges can encourage parents, students, and teachers to view anatomy, geometry, physics, calculus, architecture, computers, and other topics which feature mathematical and scientific concepts as viable options for all students--regardless of gender.

Recommendations for Further Study

The relationships found through this research suggest that further study is warranted. First of all, it would seem logical to replicate this study on a larger scale to determine if the results would be similar and to focus on subjects that are more representative of the general population in terms of achievement and race. Secondly, it would be interesting to explore the same variables in a follow-up study using the original study's sample to determine if the gender differences have increased, decreased, or remained the same. Finally, of particular interest would be studies which attempt to uncover the reasons for the differing results of fifth and sixth grade respondents, with regard to gender and career interests.

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